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(54) Brake shoe and process for its production

(57) In the production of a brake shoe which comprises a carrier plate 22, an intermediate layer 24 and a friction lining 23, a heat-hardenable composition is mixed with a heat-actuatable adhesive, and the mixture is applied to a fibrous web 7 and is uniformly spread and then dried. An intermediate layer of appropriate size is then obtained from the composition and is subsequently joined to the carrier plate and a powdered friction layer material by pressing and heating to form the finished brake shoe. The intermediate layer may, prior to the application of the friction layer material and of heat and pressure, be bonded to the carrier plate using a solvent which partially activates the adhesive, so that the carrier plate and attached intermediate layer form a unit which can be stored prior to application thereto of the friction layer material.

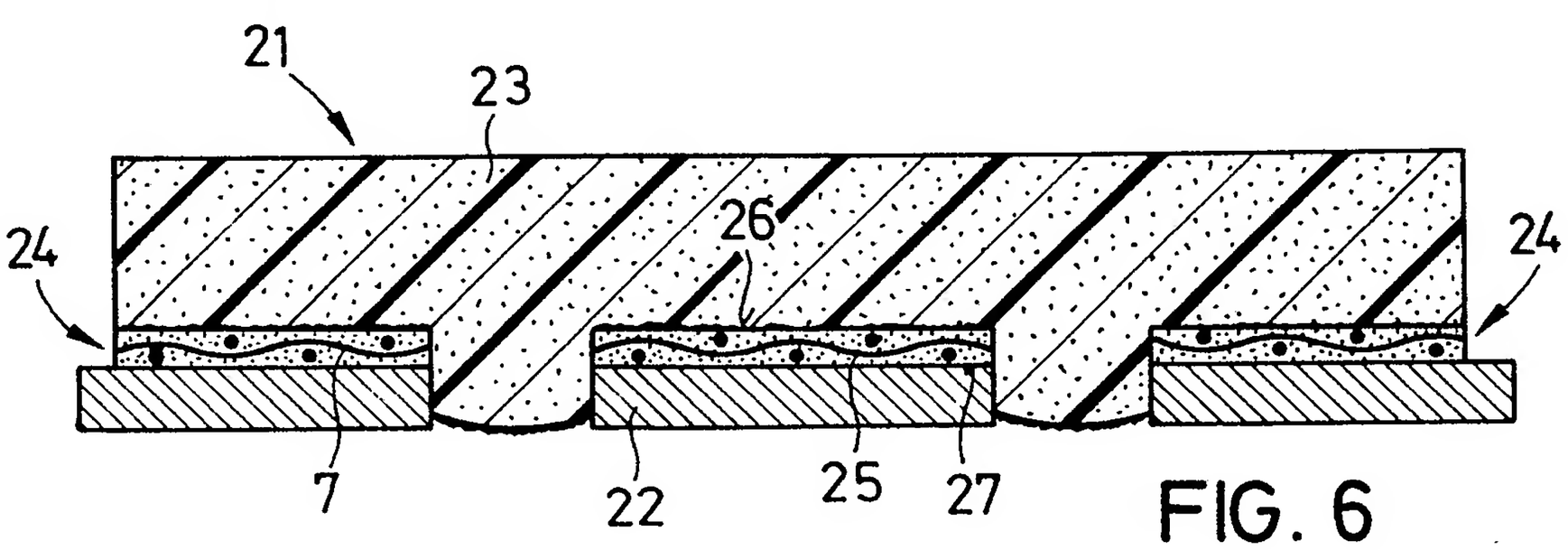

FIG. 6

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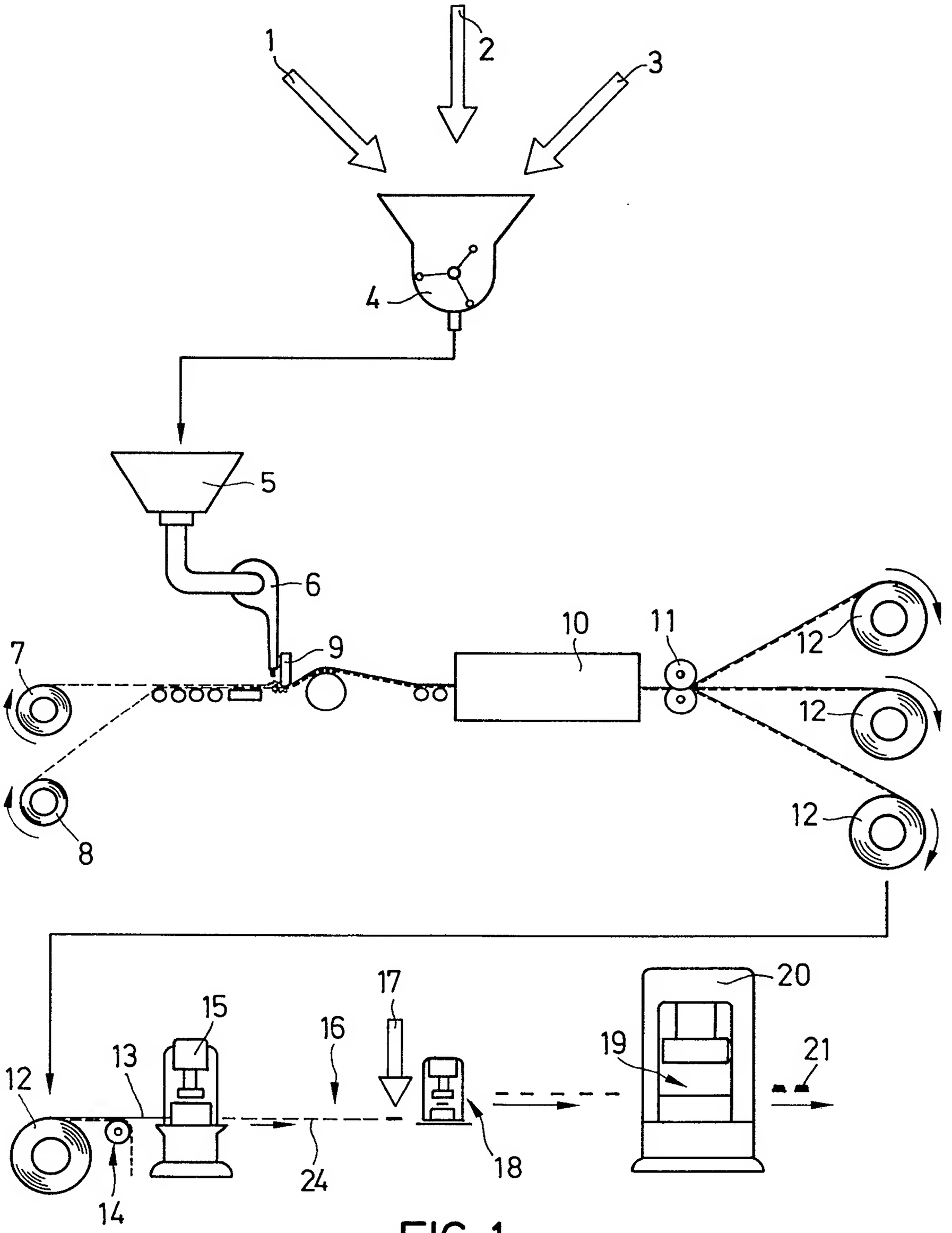

FIG. 1

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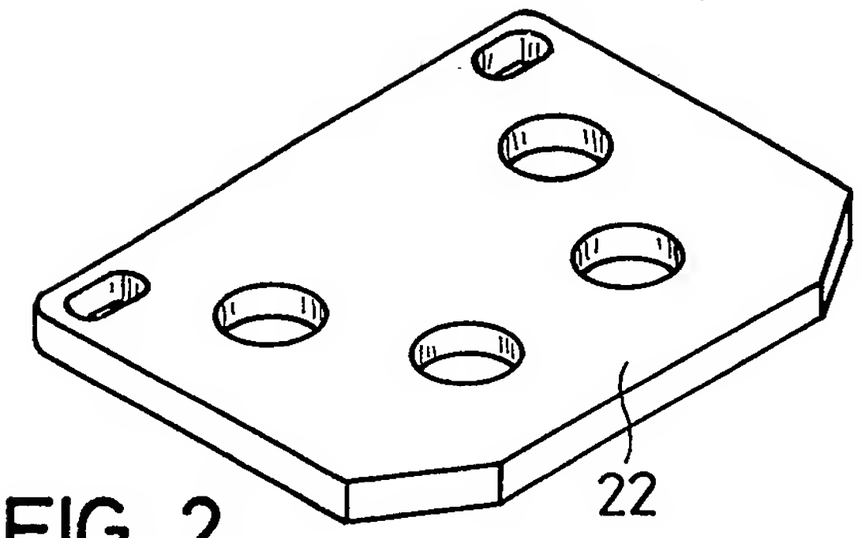

FIG. 2

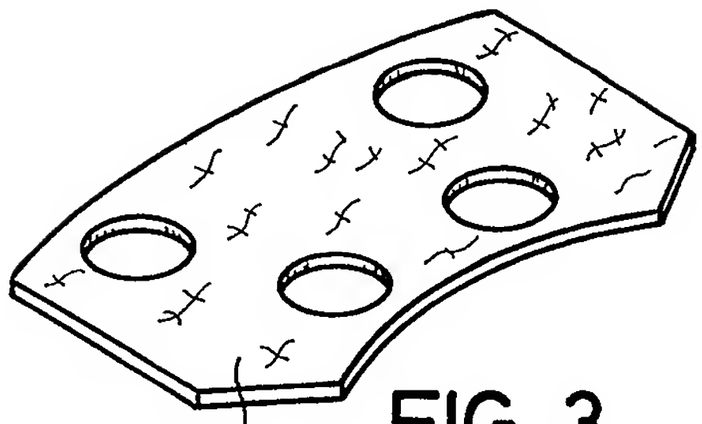

FIG. 3

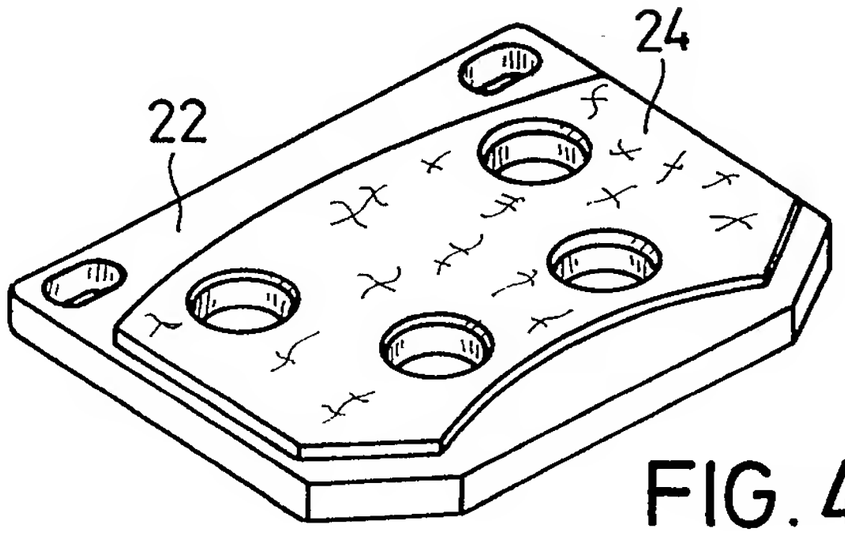

FIG. 4

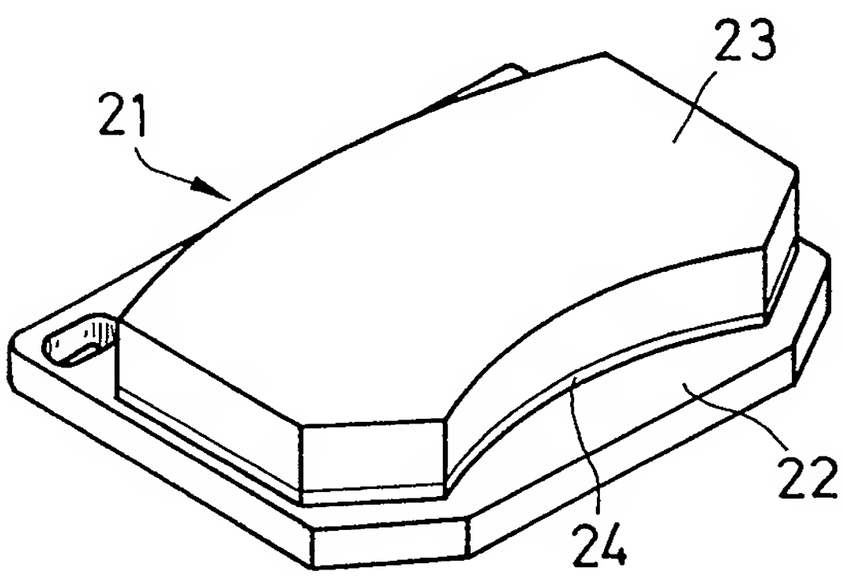

FIG. 5

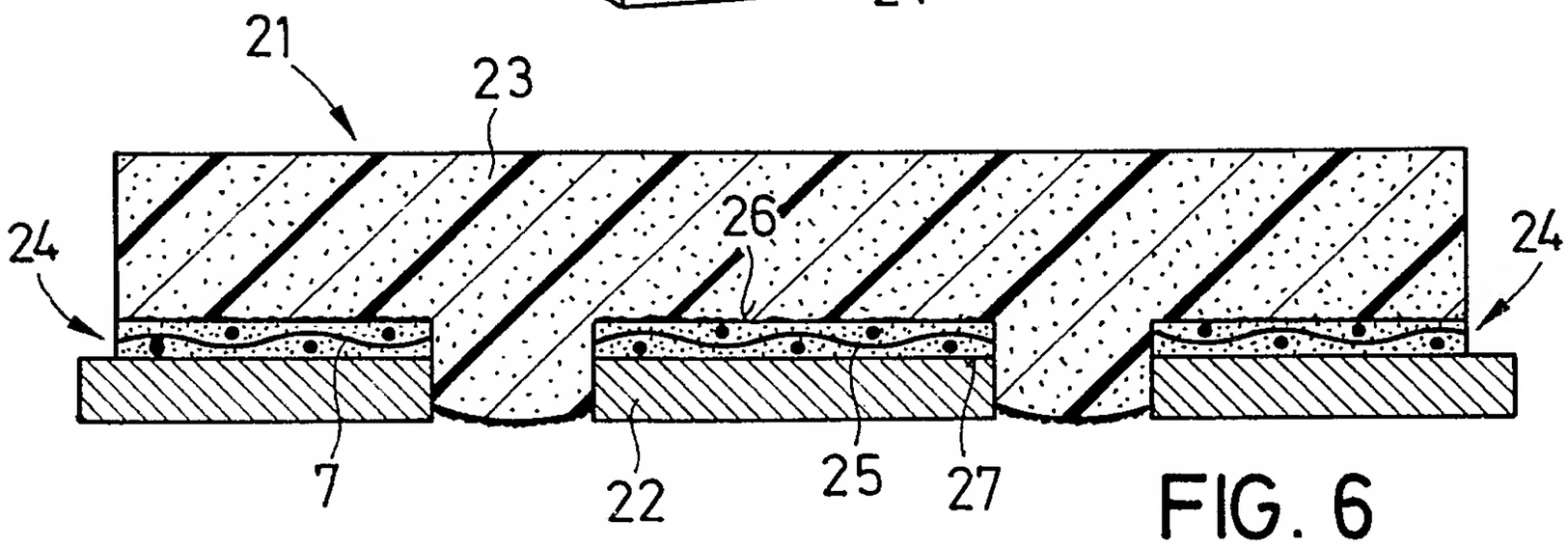

FIG. 6

SPECIFICATION

Brake show and process for its production

The invention relates to a brake shoe and more particular, but note exclusively, is concerned with a brake shoe for a disc brake, which comprises a carrier plate, an intermediate layer and a friction lining, and to a process for its manufacture.

It is known to provide a brake shoe comprising an intermediate layer between a carrier plate and a friction lining. According to the properties desired, such as thermal insulation, sound proofing, protection against corrosion, compound strength and the like, the intermediate layer can contain the different components needed to form a basic heat-hardenable synthetic material e.g. phenol synthetic resin, epoxy resin and the like and it further has the task of improving the bonding of the friction lining to the carrier plate and hence increasing the shearing strength of the shoe.

It is further known to provide reinforcement by means of short glass fibre pieces in the intermediate layer.

Production of the brake shoe is generally carried out by introducing the intermediate layer in powder form into a mould and, together with powdered friction material and the carrier plate, which is coated with a heat-actuable adhesive, pressing it to form a brake shoe.

It is true that in this way good strength values are produced, but in the transition region between the friction lining and the intermediate layer the dividing line between the layers is not exactly defined, since completely uniform feeding of the intermediate layer powder into the mould is not possible under production conditions. Thus, with increasing wear of the lining, the partial abrasion of the intermediate layer causes an undesirable change in the friction coefficient before the friction lining has been fully worn out.

In addition the technical expenditure involved in pressing a powdery intermediate layer material is considerable since a special weighing- and dosing device is necessary for the intermediate layer material at each pressing.

To avoid these disadvantages, for certain applications the processing of the intermediate layer material has been done by rolling or the like to form an intermediate layer plate. A carrier plate coated with adhesive, the intermediate layer plate and a powdery friction material are inserted into the mould and the whole thing is pressed to form a unit. This produces a substantially exactly defined interface between the friction lining and the intermediate layer and is also simpler than the process involving pressing of a powdered intermediate layer. It has been found, however, that the strength values of brake shoes produced in this way do not reliably achieve the desired level since the process of manufacturing the intermediate plate, by rolling or the like, seals the surface of the intermediate plate, which reduces the adhesion between the friction lining and the intermediate plate.

With this process strict limits are imposed on adjusting the intermediate layer to adapt to the respective requirements, such as thermal insulation, sound proofing, compound strength, protection against corrosion and so forth, since the specified minimum strength values can only be obtained with a restricted range of compositions of the intermediate layer material.

The invention provides a process for manufacturing a brake shoe, and a brake shoe thereby produced where a simplified production process leads to brake shoes having linings with a high shearing resistance while retaining the other desirable positive properties of the intermediate layer, such as sound proofing, thermal insulation, protection against corrosion and so on.

According to one aspect of the present invention there is provided a brake shoe comprising (i) a carrier plate, (ii) a friction lining, and (iii) an intermediate layer between the carrier plate and the friction lining, said intermediate layer comprising a fibrous web coated with a heat hardened composition comprising a heat activated adhesive.

According to a further aspect of the present invention there is provided a process for the production of a brake shoe, comprising:

(i) providing a heat hardenable composition containing a heat activatable adhesive;

(ii) coating a fibrous web with the composition to form an intermediate layer;

(iii) forming an assembly comprising a carrier plate, the coated fibrous web superposed on the carrier plate, and a layer of powdered friction material on the coated fibrous web, and

(iv) subjecting the assembly to heat and pressure to form the powdered friction material into a coherent friction lining and to bond this lining, the coated fibrous web and the carrier plate together to form the desired brake shoe.

Any suitable known heat-actuatable adhesive may be used for the intermediate layer material, such as ethylene-vinyl acetate copolymers, polyamides, aliphatic or aromatic polyesters, epoxy resin compounds, poly (ethylene glycol) dimethacrylates, phenolic resins, and PVC solvent adhesives.

The febrous web is preferably in the form of a glass fibre mat.

When producing the brake shoes in accordance with the invention, the intermediate layer may

be produced by mixing the heat hardenable composition with optional additives to obtain a paste of desired viscosity and applying it to the fibrous web to form a coating which is spread on the web by, for example, blades to give a coating of uniform thickness. The coating is then dried. A piece having a shape appropriate to the carrier plate is then cut or stamped out of the dried coated web and is then superposed with the carrier plate and the powdery friction material and subjected to heat and pressure to form the desired brake shoe.

The heat-actuatable adhesive which is incorporated into the intermediate layer material ensures a good bonding of the carrier plate to the intermediate layer. Good bonding of the friction lining with the intermediate layer is due to the fact that, while there is in fact a flat surface which guarantees a definite dividing line between the friction lining and the intermediate layer material, the surface of the intermediate layer on this dividing line has sufficient roughness to allow particularly good adhesion to the friction lining. This considerably increases the shear resistance of the lining as compared to the case where the intermediate layer is made by the usual procedure of rolling or pressing, which makes its surface too smooth. In addition the skeletal supporting structure of the glass fibre mesh increases the strength of the intermediate layer and thus contributes to the necessary shear resistance of the lining with respect to the carrier plate, significantly increasing reliability.

It has been found that the heat-actuatable adhesive incorporated into the intermediate layer material can also be partially actuated by solvents to give it a tacky surface. This fact can advantageously be utilised by the application of a drop of solvent to produce a preliminary adhesion between the carrier plate and the intermediate layer of the invention.

A carrier plate pre-fabricated in this way leads to considerable simplification in production since for the preparation of the brake shoe only two parts, the prefabricated carrier plate and the powdered friction layer material, have to be joined together by pressing and heating to form a brake shoe.

For the production it is advantageous to use a glass fibre web with the following data:
Glass fibre web with leno weave
Thread distribution of the warp threads about 4–8 per cm
Thread distribution of the weft threads about 2–3 per cm
Thread thickness about 0.6–1.2 mm

The intermediate layer produced according to the invention can be optimised for different purposes.

Examples 1 to 3 are examples of suitable compositions for the basic material for the intermediate layer in weights%.

Example 1 Optimisation of thermal insulation
Example 2 Optimisation of bond rigidity
Example 3 Optimisation of sound proofing

Raw Material	*Example 1*	*Example 2*	*Example 3*
phenol-novolak	15	20	–
phenol-cresol-novolak	–	–	15
mineral fibre	30	20	20
Fe or non-ferrous metals	40	35	45
calcium hydroxide	5	5	5
heavy spar	–	11	5
polyaramide	3	5	2
rubber	–	–	3
vermiculite	7	4	5

The composition of the friction lining is not the subject of the invention, but may include, for example, inorganic fibres, such as iron fibres, a filler, such as metal filings, metal oxides and other minerals and an organic binder such as phenolic resin or natural or synthetic rubbers.

The invention will be explained by means of the examples shown in the drawings.

Figure 1 shows a diagrammatic representation of the process sequence.

Figure 2 to 5 show schematically an embodiment of the individual parts and of the brake shoes.

Figure 6 shows a cross section through a brake shoe produced in accordance with the invention.

In production of the intermediate layer it is advisable to start with the production of a large sheet from a continuous process.

Referring to Fig. 1, the starting point for the production process is a composition which comprises, for example, one of the three above-mentioned mixtures. This compound 1 is intimately mixed in a solvent kneading machine 4, with the addition of heat-actuatable adhesive

2 and possibly, according to requirements, of viscosity-adjusting additives 3, until a pasty flowing material is formed.

This paste can then be taken out of a storage vessel 5 by means of a dosing pump 6. This material is fed in the correct amount by means of the dosing pump to the blade device 9 which is constructed as a floating knife in the production process (shown) by way of example. Alternatively rolling or rubber sheet blade processes can be used. In the blade procedure the pasty intermediate layer material is applied to uniform thickness on a glass fibre mesh 7 taken from a roll/coil. So that this intermediate layer material does not stick or adhere to the transport device during the production process, siliconised paper 8 is fed under the glass fibre mesh.

Single-sided or double-sided siliconised paper is used depending on the degree of drying which can be achieved for the different formulae in the drying path 10. Double-sided siliconised paper is used when the degree of drying of the intermediate layer which can be achieved in the continuous process after the drying path is so low that there is the danger of the individual intermediate layers sticking together when they are wound into a coil. In this case, which is also the basis of the production process of Fig. 1, the double-sided siliconised paper would be wound up together with the band-shaped intermediate layer to form coils.

When there is a sufficient degree of drying then only one-sided siliconised paper is used which is removed before it is wound up to form coils 12. In both methods after the drying path a further separating device 11 is provided (e.g. circular blade shears), in which the band material is split into the widths necessary for further processing before it is wound up to form coils 12 of various widths.

After transport and possible stockpiling, intermediate plates are cut out or stamped out in a cutting or stamping device 15 from the intermediate layer material 13, with the correct width for the dimensions of the intermediate plate.

When using a double-sided siliconised paper, which has been wound up into the coil, this is removed at 14 from the band-like intermediate layer material before the stamping/cutting process. After the stamping/cutting process, in which the contour of the intermediate plate 24 (Fig. 3) is determined in accordance with the outer contour of the friction lining and the retaining bores of the lining carrier plate, a small amount of solvent 16 is now added to the side of the intermediate plate 24 which faces the carrier plate 22 (Fig. 2). This solvent causes a slight actuation of the adhesive incorporated into the intermediate layer material. When the lining carrier plate 22 has been supplied 17 the intermediate plate 24 is then aligned onto the carrier plate and is pressed with a slight pressure 18. The adhesive actuated by the solvent thus causes a slight adhesion between the carrier plate and the intermediate plate.

The carrier plate now prefabricated with the intermediate plate (Fig. 4) forms a bonded unit which can be separately handled and kept in store before further processing.

The prefabricated carrier plate (Fig. 4) is now introduced into the press 20 and is pressed with the powdery friction material 19 in a mould to form the brake shoe. Fig. 5 shows this brake shoe 21 and it can be clearly seen that the outer contour of the intermediate plate 24 corresponds exactly to the outer contour of the friction lining 23.

The brake shoe (Fig. 5) which has a carrier plate 22 of specified configuration and a friction lining 23, contains an intermediate layer plate piece 24 which is formed from a mixture of the basic intermediate layer material and a heat-actuatable adhesive, in which mixture a glass fibre mesh 7 is embedded. The intermediate layer plate piece is of uniform thickness and has a flat and roughened surface 26 and 27.

By ensuring the necessary shear-resistance for the brake shoe it is possible to optimise the properties of the intermediate layer within wide limits by modification of the formula of the intermediate layer composition for different requirements, like thermal insulation, sound proofing, bond rigidity and protection against corrosion and at the same time to guarantee simple handling in production.

CLAIMS

1. A brake shoe comprising (i) a carrier plate, (ii) a friction lining, and (iii) an intermediate layer between the carrier plate and the friction lining, said intermediate layer comprising a fibrous web coated with a heat hardened composition comprising a heat activated adhesive.

2. Brake shoe according to claim 1, wherein the fibrous web has warp threads of four to eight threads per cm, weft threads of two to three threads per cm and the thread thickness is from 0.6 to 1.2 mm.

3. Brake shoe according to claim 1 or 2, wherein the outer contour of the intermediate layer corresponds to the outer contour of the friction lining.

4. Process for the production of a brake shoe, comprising:

(i) providing a heat hardenable composition containing a heat activatable adhesive;

(ii) coating a fibrous web with the composition to form an intermediate layer;

(iii) forming an assembly comprising a carrier plate, the coated fibrous web superposed on the carrier plate, and a layer of powdered friction material on the coated fibrous web, and

(iv) subjecting the assembly to heat and pressure to form the powdered friction material into a coherent friction lining and to bond this lining, the coated fibrous web and the carrier plate together to form the desired brake shoe.

5. Process according to claim 4 in which the intermediate layer sheet is dried after the coating process.

6. Process according to claim 4 or 5, where the intermediate layer is cut to stamped into an appropriate size before the assembly is formed.

7. Process according to any of claims 4 to 6, wherein the heat-hardenable adhesive can also be at least partly actuated by a solvent, and in that the coated web is made to adhere to the carrier piece by means of the solvent for the adhesive before the friction material is applied.

8. A process according to claim 7, wherein the fibrous web and the carrier plate are handled or stored as a separate bonded unit before assembly with the friction layer.

9. A brake shoe as claimed in claim 1 substantially as hereinbefore described with reference to, and as illustrated in, Fig. 5 of the accompanying drawings.

10. Process according to claim 4 substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawings.

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ABSTRACT:

CHG DATE=19990617 STATUS=O> In the production of a brake shoe which comprises a carrier plate 22, an intermediate layer 24 and a friction lining 23, a heat-hardenable composition is mixed with a heat-actuatable adhesive, and the mixture is applied to a fibrous web 7 and is uniformly spread and then dried. An intermediate layer of appropriate size is then obtained from the composition and is subsequently joined to the carrier plate and a powdered friction layer material by pressing and heating to form the finished brake shoe. The intermediate layer may, prior to the application of the friction layer material and of heat and pressure, be bonded to the carrier plate using a solvent which partially activates the adhesive, so that the carrier plate and attached intermediate layer form a unit which can be stored prior to application thereto of the friction layer material. □